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BUSHFIRES - AN INTEGRAL PART OF AUSTRALIA'S ENVIRONMENT

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INTRODUCTION

The January 1994 bushfires in New South Wales have renewed, once again, the public awareness of the susceptibility of Australia to fire. However, our history suggests that this awareness will be short-lived for the majority of the population. One of the consequences of improved bushfire control is that fewer and fewer people have a regular association with fire. This is reflected in changes in community attitudes towards fire and their own ability to live with what is a very natural and very Australian phenomenon. A better understanding of fire principles, better equipment and better communication by fire authorities will continue to reduce the average area of countryside burnt each year. However, it is because of this that the general public will be less prepared and more reliant on external services and perhaps more prone to disasters in the future.

The bushfires in New South Wales were extensive but mostly confined to the coastal strip between Batemans Bay in the south to the New South Wales/Queensland border and generally less than 100 kilometres inland from the coast. Many of the fires burnt in rugged and largely uninhabited country managed for national parks or nature reserves and did little quantifiable damage. The most damaging fire of the period was one of the smallest. The Como/Jannali fire burnt only 476 hectares, yet the fire destroyed 101 houses, which was more than half of the total house losses for all of New South Wales during the January bushfire emergency period. Our history, and the experience of countries overseas with similar fire climates, are that disasters on the urban bushland interface are likely to be more serious in the future.

Fire Climate

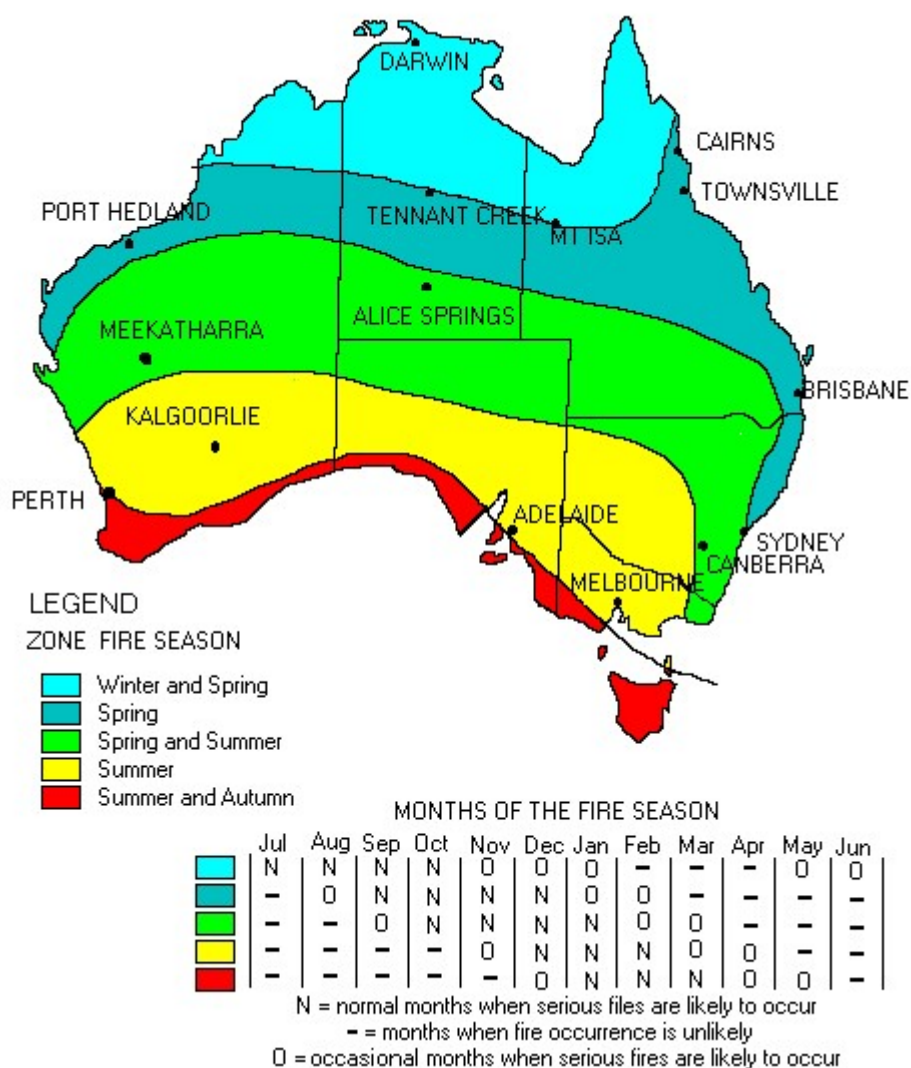
The geographic location and the topography of Australia mean that almost all vegetation types in the country are fire prone. There are few high mountains and no truly alpine regions. Only the tropical rainforests of north Queensland can be said to be virtually fire-free. Even the normally arid interior of the country is capable of carrying extensive fires. In 1974-75, lush growth of grasses and forbs following exceptionally heavy rainfall in the previous two years provided continuous fuels through much of central Australia and in this season fires burnt over 117 million hectares or 15 per cent of the total land area of this continent.

The fire season in different regions of Australia depends primarily on latitude. In northern Australia the main fire season is winter and spring (the dry season of wet-dry tropics) and when the prevailing wind direction is from the south-east. The fire season in southern Australia is predominantly summer and autumn (see Figure 1). The most severe fire weather occurs in the south-eastern corner of Australia south of a line between Adelaide and Sydney. This is where high pressure systems located in the Tasman Sea can force hot, dry air from the centre of the

continent and where low pressure troughs travelling across the southern ocean can form very strong pressure gradients and produce very strong, dry winds. In other parts of the country strong winds during the dry season are rare; they are generally associated with the tropical cyclones and are mostly heavily moisture laden, though, on occasions, cyclonic winds have caused havoc during the fire season in Western Australia.

The south-eastern areas of Australia and Tasmania along with the south-west corner of Western Australia also produce the tallest forests and associated heavy fuel loads. These wet forests occasionally dry out and under extreme fire weather, these heavy fuels produce the most intense and devastating bushfires. So the greatest potential for a bushfire disaster is where people have built in close proximity to the tall, wet forests of southern Australia.

FIGURE 1 BUSHFIRE SEASONS IN AUSTRALIA



Bushfires in Pre-European Times

Historical accounts record that Aborigines burnt extensively and often. Although they had little capacity for fire suppression there seems little doubt that they had a very extensive knowledge about when and where particular areas would burn and the biological consequences of their

burning. They burnt some areas early in the fire season, before fires would spread extensively, to protect them from fires later in the season. When the weather conditions were appropriate they burnt to promote the flowering and fruiting of certain edible plants. They used fire extensively for warfare, for providing access through thick vegetation, for hunting, for warmth, and for protection against snakes and insects. Their traditions, it seems, did not value areas that were left unburnt for a long time, for much of the burning was done with no specific objective in mind other than 'to clean up the country'; an attitude and practice that still remains with Aboriginal people living in inland Australia today.

While they appeared to manage fire by burning early in the dry season to create green pick and to protect special areas, Aborigines also burnt late in the season with little apparent concern for the downwind consequences of the fire. For example, fires for hunting drives were reported to be lit during hot, dry windy weather when grasses were fully cured. Fires were lit in a horseshoe shape into the wind and, although some control was exercised on the backing fire to force animals out through the opening in the horseshoe as the fire encircled them, the head fires were allowed to run with the wind.

The repeated observation of the first explorers were of open forests and woodlands with a grassy understorey and the impression of an annual conflagration during the fire season. In May 1770, Captain James Cook described the vegetation and country on Botany Bay's southern shore as '... the country which we found diversified with woods, lawns and marshes; the woods are free from underwood of every kind and the trees are such a distance from one another that the whole country might be cultivated without being obliged to cut down a single tree ...' and elsewhere '... the moors looked like our moors in England and as no trees grow upon it but everything is covered with a thin brush of plants about as high as the knees.' This description fits a vegetation which is burnt annually, or in the case of heathlands, every two to three years. These observations were repeated by other explorers that pushed further inland from the coast up until about 1850.

Annual burning is only possible in vegetation types such as the tropical and subtropical woodlands where there is a substantial proportion of grassy fuels. The temperate woodlands may or may not burn every summer depending on the distribution of summer (dry season) rainfall and the extent of perennial grasses. It is obvious that much of the tall, dry forests and heathlands of today were originally of more open character and carried a substantial sward of grassy fuels that did permit annual or biennial burning.

Historically, it also seems that the Aborigines did not favour the tall, wet forests of southern Australia and these, being naturally moist, even in summer, burnt only under extreme fire weather conditions when the forest fuels dried out and were ignited by fires from the open woodlands and dry forests. These conditions occurred every 50 to 200 years and the resulting fires were very intense and extensive, regenerating tracts of even-aged forest.

It seems likely that most of the dry forests and woodlands of Australia had a fire regime perpetuated by Aboriginal Australians that was similar in many respects to the annual burning regime in northern Australia today. Fires were lit frequently throughout the year and in the dry season when grasses were fully cured, and burnt unchecked until they ran into an area that had been burnt some time previously. Fires were not particularly intense even on days of extreme fire weather because the fuels were light.

After European Settlement

As soon as the Europeans established permanent towns and farms, there was pressure to reduce the number and frequency of Aboriginal ignitions. This started a change in the fire regimes over much of the country from one of annual burning to regimes of somewhat longer

frequencies. As soon as Aboriginal burning ceased, the regrowth of the vegetation was extremely rapid and within a few years the grass was 'choked by underwood' and by the regeneration of young trees. Major Mitchell describes 'the omission of the annual periodical burning by natives, of the grass and young saplings has already produced in the open forest lands nearest to Sydney, thick forests of young trees, where, formally, a man might gallop without impediment and see whole miles before him.' This regeneration of forests around Sydney was repeated in other parts of Australia and is still happening today in areas of north Queensland. The cessation of annual burning by graziers in lands newly reserved for national parks is allowing open forests and woodlands to develop into closed forests. In other areas, the open eucalypt woodlands on the rainforest fringes, which had been maintained by periodic burning, are now being invaded by rainforest species.

Despite the popular view that European settlement increased the frequency of fire in the country, it is clear from the historical evidence that as European settlement increased, fire frequency decreased. As fire frequency decreased, however, the fuels built up and when fires did occur they were more intense than fires under the Aboriginal annual burning regime.

For a period around 1850 to 1900, there was deliberate firing of the vegetation by Europeans associated with minerals prospecting. Burning was widely used to clear scrub and litter and expose the underlying rocks. Where this was carried out in dry forests carrying substantial regeneration and heavy fuel build up after the cessation of annual Aboriginal burning some years earlier, the fire intensities were dramatically increased. The prospectors did extend burning into wet forests which were not regularly frequented by Aborigines but this effect was probably relatively localised.

Burning was undertaken by graziers to clear land of rough shrub and coarse grasses and to produce green pick for cattle on rough bush leases. This burning differed from Aboriginal burning both in timing and in frequency. The frequency of graziers burning has been progressively decreasing over the past 200 years. Several observers quoted graziers firing parts of the country as often as every three to four years up until the 1920s but for most of southern Australia the frequency now is very much less than this.

Legislation and Management

Legislation to specifically limit the lighting and spread of bushfires was established at different times in different States around the 1880s. The first ordinance 'to diminish the dangers from bushfires' was established in Western Australia in 1847 followed by the Bushfires Acts in South Australia and Tasmania. Organised protection from fire was not possible until much later. In the early 1900s forestry departments were established and advocated complete protection from fire caused by the miners and the graziers. Still, legislation lacked any impact until after the disastrous fires of February 1926 when sweeping changes were made in almost every State. Lighting of fires during the fire season was prohibited, forestry departments were strengthened and volunteer bushfire brigades were formed to control fires in rural areas.

From 1926 to 1970, every major change in fire management followed a major fire disaster and in this period most of the disasters resulted when graziers' fires burning during an extended spring drought continued into summer. The year of change was different in each State: 1939 and 1944 in Victoria, 1952 and 1968 in New South Wales, 1961 in Western Australia and 1967 in Tasmania. Along with the increasing tide of legislative restrictions and control, was the progressive reservation of vacant crown lands - initially for forestry and later for national parks - and progressive improvement in agricultural grazing land. Increasingly there were assets such as homesteads, stock, crops and fencing that demanded protection from wildfires and, more recently, the threat of litigation from neighbours burnt out by escaped fire has made graziers more circumspect with their burning.

Fire Ecology

Eucalypts appeared in the fossil record around 80 million years ago. With them were charcoal fragments, and indication of the long association of fire with Australian flora. Although there have been substantial changes in the vegetation associated with change in climate, the fossil record shows that whenever there was a change to a drier environment with associated sclerophyll vegetation, there is also an increase in the frequency of fire. For example, in the Lake George area of New South Wales, whenever there was a shift from plants favoured by a cool temperate climate to plants which were favoured by a dry arid climate (for example, the eucalypts), there was an increase in charcoal associated with the plant pollen. There was a substantial increase in the amount of charcoal present between 200,000 and 250,000 years before present which is well before Aborigines were considered to be within the area. Since then, the presence of natural ignition from lightning and the extensive burning practices of the Aborigines have influenced the development of our forests and heathlands and resulted in a natural mosaic of plant community ages throughout Australia.

Although wildfire is detrimental to our rural production and the built environment, it should be considered to be as much a part of the natural environmental of our forests and heathland ecosystems as the sun and the rain. Some Australian plants are stimulated to flower by the presence of fire or smoke, while others have seeds which require some heat treatment before they will germinate. There is a suite of specific plants and animals which are associated with each fire regime. Annual burning favours communities of grasses and herbs, which in turn are preferred by kangaroos and larger wallabies. The tall eucalypts of the mountain forests of Victoria and Tasmania have seeds which are so small that they will not survive in the deep litter beds that accumulate beneath them. These species require an intense fire under dry conditions to remove the accumulated organic matter on the forest floor so that the tiny eucalypt seedlings can grow and regenerate the forests. If these forests do not receive a fire within their life span, (which is about 250 to 350 years), they will die out and be replaced by temperate rainforest species. In between these two extremes are other plants which have the capacity to produce abundant shoots from stems or lignotubers after fire and so can withstand frequent and repeated firing at regular intervals.

Similarly, some species of our native fauna are favoured by burning at regular intervals, others prefer intermediate intervals between fire, while yet others require long periods without fire for their optimum development. When considering fire in relation to fauna, it is important not to confuse temporary impacts on individual animals with longer term trends which often have a net beneficial effect. During any fire some animals will perish. However, in the absence of fire, changes in vegetation may cause the decline and disappearance of some species. The interdependence of plants and animals with a particular fire frequency can be quite complex. For example, the small rat kangaroo or woylie of Western Australia has a diet which consists mainly of the underground fruiting bodies of a fungus. The fruiting of the fungus is related to the amount of nitrogen in the soil which is, in turn, related to the vigour of understorey plants which are capable of fixing nitrogen. Thus, the optimum conditions for this animal requires a fire frequency which regenerates the understorey shrubs (in the absence of fire the shrubs die out) and yet provides other areas where the shrubs are intact with shelter from predators.

Introduced animals have had a huge impact on the smaller native fauna whose interaction with fire is complicated further by the grazing of native vegetation by rabbits and the predation by foxes and feral cats. It is considered by many that these influences are having a much greater impact on our fauna than the changed frequency of fire.

The Nature of Bushfire Disasters - Past and Future

A natural disaster occurs when a natural phenomenon impacts on a vulnerable population. The severity and magnitude of a bushfire depend upon both the severity of the prevailing weather conditions and the amount of fuel available for combustion. Under a frequent burning regime, heavy fuel loads do not accumulate and so extreme fire intensities cannot occur even though fires may spread rapidly in grassy fuels. The most intense conflagrations will occur in those locations where there is the potential for extreme fire weather and the accumulation of heavy fuel loads. In Australia, these locations are the tall, wet forests of the temperate zones of Victoria, south-western Western Australia and southern Tasmania.

For a conflagration to be a disaster depends on the vulnerability of the population and their level of preparedness. The historic fire disasters of the past occurred when numerous fires left to burn by graziers burnt huge areas under extreme conditions. In 1939, 71 lost their lives, mostly from timber towns in the forest lands of Victoria. In 1967, on 7 February, there were 110 fires burning within a 25 mile radius of Hobart in southern Tasmania before the onset of extreme fire weather. These fires converged together over a period of seven hours and devastated the suburban fringes of Hobart and towns in the channel districts to the south of Hobart. These fires burned 264,000 hectares, 61 lives were lost and more than 1,700 homes destroyed. On 16 February 1983 (Ash Wednesday), 15 major fires in South Australia burnt out 160,000 hectares, killed 28 people and destroyed 383 homes. On the same day, eight major fires in Victoria burnt out 183,000 hectares, wiped out several towns and seaside resorts, 47 people perished and 2,186 homes were destroyed. In 1994, in New South Wales, between 21 December and 16 January, more than 800 fires burnt more than 800,000 hectares and totally destroyed 287 residential properties and other premises. Four people were killed.

However, in each of the recent fire disasters, the major losses have occurred when a single fire burnt into a residential area, either a major town or on one of the city fringes as shown in Table 1. The total area burnt by the Como/Jannali fire, which burnt entirely within the suburban development of greater Sydney, was only 476 hectares, yet this was responsible for more than half the residential house losses in the recent New South Wales fires. Similarly, in the Tasmanian disaster, very substantial losses occurred from a relatively few fires; one of the major ones being the Hobart fire which burnt only 6,660 hectares, killed 20 people and destroyed 310 homes and other buildings.

Historically, major disasters have occurred where severe fires are least frequent. In the future it is likely that the frequency of burning per se is likely to decrease and, as a consequence of this, the vulnerability of the population to fire is likely to increase. In the past, the perimeter of major cities between the urban area and the bushland was often well defined with a substantial fire break or fuel-modified area which separated the town from the rural vegetation. Residential sites were substantially cleared of bush before development and the size of normal residential blocks gave little scope for regeneration of natural bush. There is now an increasing tendency for people on the outskirts of major cities and towns to purchase larger blocks of from one to 20 hectares and build their homes without substantial clearing of the native vegetation or, where this land had previously been pastoral land, regrowth and regeneration of the native vegetation has been encouraged.

In addition to living more intimately with the fuels, the people living in these areas have little understanding of bushfires or fire behaviour. They have often urban-based employment and many expect fire protection to be provided as a service and seem reluctant to join a volunteer bushfire brigade to provide fire protection as a cooperative self-help operation. Without the experience of regular fires under mild conditions, the residents of these areas can be totally unprepared for the occasional wildfire burning under extreme fire weather conditions. Fewer precautions will be taken to clear fuels around individual houses and the concentration of house losses is likely to be greater than in the past.

The overseas experience in areas with a similar fire climate to Australia follow the same trends set out above. People are building houses on larger blocks with more wildland fuels being retained in an undisturbed state. The East Bay Hills fire of 20 October 1991 burnt through an urban/rural residential area in Oakland and Berkeley Hills, California. The total area of the fire was only 615 hectares, yet 25 people were killed, 2,777 separate family residences and more than 400 apartments were destroyed. Because of its urbanisation, the area had a relatively low frequency of fire but when severe weather conditions prevailed, the intermix of houses, forest and scrub fuels on steep slopes produced a wildfire that was impossible to contain until the weather conditions moderated. Ironically, some 20 per cent of the vegetation was Australian eucalypts.

TABLE 1 MOST SIGNIFICANT SINGLE FIRES IN URBAN/RURAL WILDFIRE DISASTERS IN AUSTRALIA AND CALIFORNIA

Year	Date	Location	Area burnt (ha)	Fatalities	Homes destroyed
AUSTRALIA					
1964	14 January	Dandenong Ranges, Victoria	2000	8	454
1967	7 February	Hobart, Tasmania	6600	20	310
1983	16 February	Upper Beaconsfield, Victoria	9200	21	238
1983	16 February	Macedon, Victoria	29500	7	628
1983	16 February	Mt Osmond, South Australia	3885	9	9,100+
1994	8 January	Como/Jannali, New South Wales	476	1	101
CALIFORNIA, UNITED STATES OF AMERICA					
1961	n.a.	Bel-Air, Los Angeles	2500	n.a.	484
1977	n.a.	Santa Barbara	325	n.a.	234
1990	n.a.	Santa Barbara	2000	n.a.	641
1991	20 October	Oakland/Berkeley	615	25	2777

Source: CSIRO Division of Forestry.

The comparatively minor losses of the Como/Jannali fire reflects different town planning where most of the housing was sharply separated from the bushland by a perimeter road or fire trail. The trend for housing intermixed with bushland fuels like the East Bay Hills area is increasing in Australia. However, where people demand residential homes on large bushland blocks, the management of fuels on these blocks to minimise the bushfire threat must become the responsibility of each and every individual. Improved building standards will help but solves only part of the problem. Unless individuals band together to maintain low fuel levels within the urban/rural residential areas, then this type of urban wildfire demonstrated within the Sydney suburbs is going to be repeated elsewhere in Australia in the future with increasing levels of property damage and disruption.

Source: Year Book Australia, 1995 (ABS Catalogue No. 1301.0)

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